

### **Remarks**

The Office Action mailed on February 28, 2005 has been carefully reviewed along with the references cited therein. In the subject Office Action, the Examiner

Rejected claims 1, 2, 3, 5, 6, 8, 10, 11 and 15 under §102(b) as being anticipated by Crivello (U.S. Patent No. 6,210,790);

Rejected claims 1-11, 14, 18-28, and 31 under §102(e) as being anticipated by Campbell et al. (Pub. No. 2004/0102529 A1);

Rejected claims 14 and 16 under §102(b) as being anticipated by, or in the alternative, under §103(a) as obvious over Crivello (U.S. Patent No. 6,210,790);

Rejected claims 16 and 33 under §102(e) as being anticipated by, or in the alternative, under §103(a) as obvious over Campbell et al. (Pub. No. 2004/0102529 A1);

Rejected claims 15 and 32 under §103(a) as being unpatentable over Campbell et al. (Pub. No. 2004/0102529 A1) in view of Wensel (U.S. Patent No. 5,959,349);

Allowed claims 17 and 34; and

Objected to claims 12, 13, 29, and 30 as being dependant upon a rejected base claim.

In this response, Applicants present various amendments and clarifying remarks believed to remedy the Examiner's rejections and objections, and place the claims in condition for allowance.

#### **(I) Amendment of Claim 1**

Claim 1 has been amended to require:

"at least one colloidal silica organofunctionalized with an organoalkoxysilane of the following formula:



wherein  $R^7$  is independently at each occurrence a  $C_{1-18}$  monovalent hydrocarbon radical optionally further functionalized with alkyl acrylate, alkyl methacrylate,  $C_{6-14}$  aryl radical, or alkyl radical;  $R^8$  is independently at each occurrence a  $C_{1-18}$  monovalent hydrocarbon radical or a hydrogen radical; and "a" is a whole number equal to 1 to 3 inclusive".

Support of the amendment can be found in Paragraph [0021] of the present application.

**(II) Claim 1 is not anticipated by Crivello**

R<sup>7</sup> of Claim 1 does not contain an epoxy group, nor does it contain a 1-alkenyl ether group. As a global restriction, the counterpart of R<sup>7</sup> in Crivello always contains an epoxy group, a 1-alkenyl ether group, or both. For example, Crivello teaches:

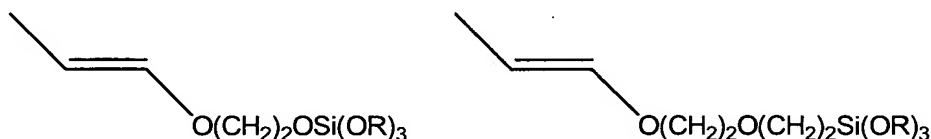
**[Abstract]:** “A method for producing such composites by preparing an epoxy- or 1-alkenyl ether-functional colloidal silica ...”

**[Summary of the Invention]:** “The present invention achieves these objectives and provides for a surface-modified colloidal silica containing epoxy- or 1-alkenylether functionality covalently bonded to a surface of a finely divided silica particle, and a process for its preparation which incorporates the steps of mixing a colloidal silica, an epoxy- or 1-alkenyl ether-functional-trialkoxysilane and an ion-exchange resin and removing the ion-exchange resin...”

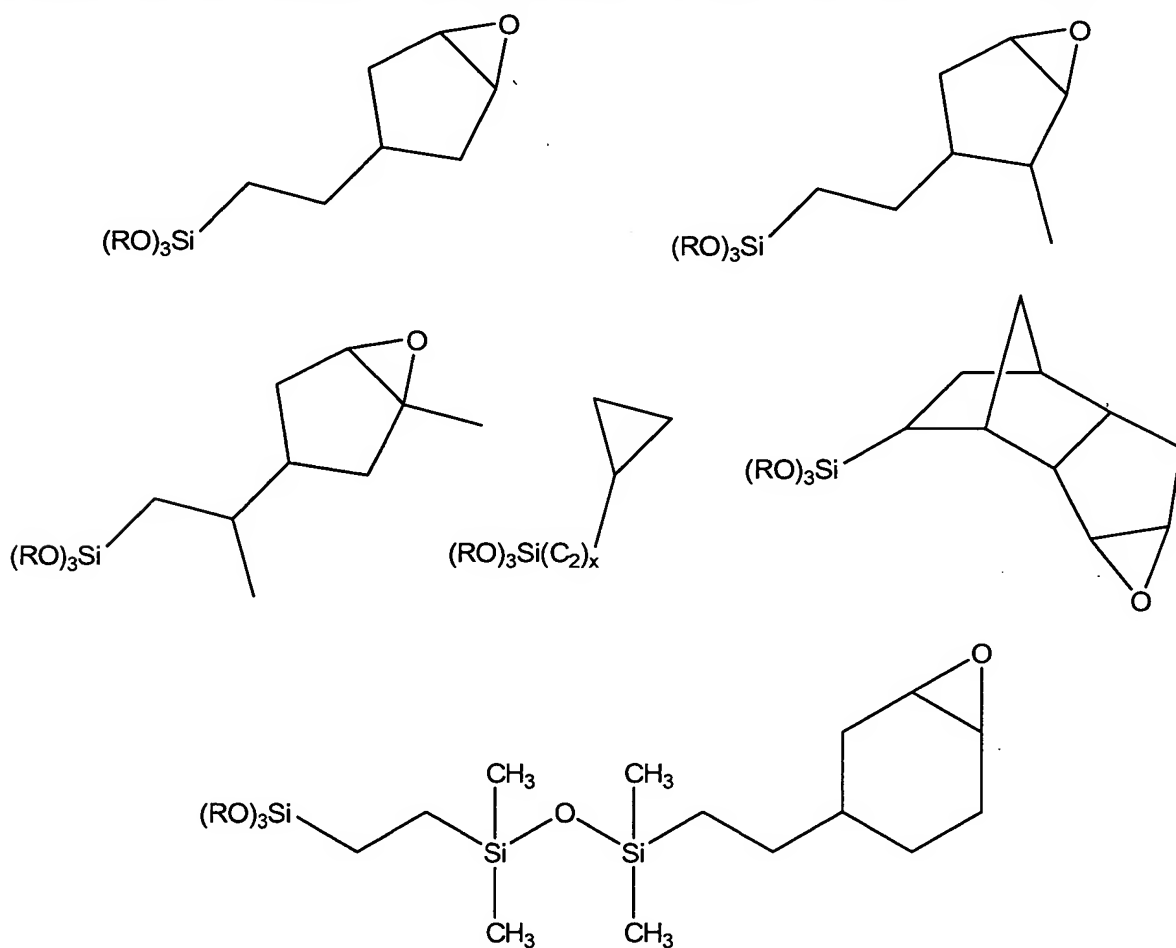
**[Summary of the Invention]:** “In another embodiment, the invention provides for a photocurable composition comprising an epoxy- or 1-alkenyl ether-functional silica and a multifunctional epoxy- or 1-alkenyl ether monomer”

**[Line 18+, Column 3]:** “The compositions of the invention contain a modified colloidal silica having epoxy or 1-alkenyl groups attached to the surface of the particle. In one aspect, the invention relates to these surface-modified silicas. In another aspect, the invention relates to a combination of the modified silica with a multifunctional epoxy or 1-alkenyl ether monomer...”

**[Line 13+, Column 4]:** “In one embodiment, colloidal silica is modified to contain 1-alkenylether functionality at the surface. These materials are prepared by a combination of a colloidal silica dispersion with a 1-alkenylether-functional trialkoxysilane coupling agent. Preferred coupling agents for the incorporation of 1-1-alkenylether-functionality are shown below.



**[Line 41+, Column 4]:** "In another embodiment of the invention, colloidal silica is modified by combining with an epoxy-functional trialkoxysilane. These materials are prepared by a combination of colloidal silica dispersion with an epoxy-functional trialkoxysilane coupling agent. Suitable epoxy trialkoxysilanes are shown below.



**[Line 11+, Column 5]:** “Preferred epoxy coupling agents are: 2-(3,4-epoxycyclohexyl) ethyltrimethoxysilane, and 3-glycidoxypropyl trimethoxysilane”, and “other preferred epoxy functional silanes are: 5,6-epoxyhexyltrimethoxysilane and 1,1,3,3-tetramethyl-1-(2-trimethoxysilyl)ethyl-3-(2-(3,4, epoxy)cyclohexyl)ethyl

disiloxane)".

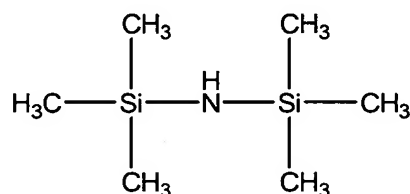
**[Example 1]:** "Trialkoxysilanes used were: 2-(3,4-epoxycyclohexyl)ethyl trimethoxysilane, 3-glycidoxypropyl trimethoxysilane, 5,6-epoxyhexyl trimethoxysilane, 1,1,3,3-tetramethyl-1-(2-trimethoxysilyl)ethyl-3-(2-(3,4, epoxy)cyclohexyl)ethyl and 1-(1-propenoxy)-2-(2-(trimethoxysilyl) ethoxy)-ethane".

**[Example 4]:** "Synthesis of 5,6-Epoxyhexyltrimethoxysilane".

Accordingly, Crivello does not anticipate claims 1, 2, 3, 5, 6, 8, 10, 11 or 15 of the present application. Furthermore, Crivello does not suggest the modification of the disclosed curable epoxy to achieve the presently claimed invention.

**(III) Claim 1 is not anticipated by Campbell et al. under §102(e)**

Campbell et al. functionalizes colloidal silica with an organoalkoxysilane first, and then functionalizes it with at least one capping agent such as hexamethyldisilazane as shown below.



The colloidal silica of Applicants' Claim 1 is **only** organofunctionalized with an organoalkoxysilane, eliminating the capping agent functionalization.

Evidence of this teaching can be found in Campbell et al.:

**[Abstract]:** "The colloidal silica is functionalized with at least one organoalkoxysilane functionalization agent and *subsequently functionalized with at least one capping agent*".

**[Claim 1]:** "A composition comprising functionalized colloidal silica wherein the colloidal silica is functionalized with at least one organoalkoxysilane functionalization agent and *subsequently functionalized with at least one capping agent*".

**[Paragraph 30]:** "Low boiling components are at least partially removed and subsequently, an appropriate capping agent that will react with residual hydroxyl functionality of the functionalized colloidal silica is added in an amount in a range between about 0.05 times and about 10 times the amount of silicon dioxide present in the pre-dispersion or final dispersion".

**[Paragraph 30]:** "Capping the functionalized colloidal silica effectively improves

the cure of the total curable epoxy formulation by improving room temperature stability of the epoxy formulation. Formulations which include the capped functionalized colloidal silica show much better room temperature stability than analogous formulations in which the colloidal silica has not been capped”.

**[Paragraph 31]:** “Exemplary capping agents include hydroxyl reactive materials such as silylating agents. Examples of a silylating agent include, but are not limited to hexamethyldisilazane (HMDZ), tetramethyldisilazane, divinyltetrametyldisilazane, diphenyltetramethyldisilazane, N-(trimethylsilyl)diethylamine, 1-(trimethylsilyl)imidazole, trimethylchlorosilane, pentamethylchlorodisiloxane, pentamethyldisiloxane, and combinations thereof”.

**[Claims 2-7]:** They all directly or indirectly depend from Claim 1. The limitation “*subsequently functionalized with at least one capping agent*” is present in all of these claims.

**[Claim 8]:** “A composition comprising functionalized colloidal silica wherein the colloidal silica is functionalized with phenyltrimethoxysilane and *subsequently functionalized with hexamethyldisilazane*”.

**[Claim 9]:** “An organic dispersion of colloidal silica comprising colloidal silica in the presence of at least one organoalkoxysilane functionalization agent, *at least one capping agent*, and at least one epoxy monomer”.

**[Claims 10-16]:** They all directly or indirectly depend from Claim 9. The limitation “*at least one capping agent*” is present in all of these claims.

**[Claim 17]:** “An organic dispersion of colloidal silica comprising colloidal silica in the presence of phenyltrimethoxysilane, *hexamethyldisilazane*, and at least one epoxy monomer”.

**[Claim 18]:** “A method for making a colloidal silica dispersion comprising (A) functionalizing colloidal silica with at least one organoalkoxysilane functionalization agent in the presence of aliphatic alcohol to form a pre-dispersion; (B) adding at least one curable epoxy monomer and optionally additional aliphatic solvent to the pre-dispersion to form a final dispersion; (D) at least partially removing any low boiling components from the pre-dispersion or final dispersion; (E) *subsequently adding an effective amount of at least one capping agent*; and (F) substantially removing any low boiling components to form a final concentrated dispersion”.

**[Claims 19-27]:** They all directly or indirectly depend from Claim 18. The limitative step of “(E) *subsequently adding an effective amount of at least one capping agent*” is present in all of these claims.

**[Claim 28]:** “A method for making a colloidal silica dispersion comprising (A) functionalizing colloidal silica with phenyltrimethoxysilane functionalization agent in the presence of isopropanol to form a pre-dispersion; (B) at least partially removing the isopropanol from the pre-dispersion; **(C) *subsequently adding an effective amount of hexamethyldisilazane to the pre-dispersion***; and (D) adding at least one epoxy monomer to form a final dispersion; and (E) substantially removing any low boiling components to form a final concentrated dispersion”.

**[Claim 29]:** “A method for making a colloidal silica dispersion comprising (A) functionalizing colloidal silica with phenyltrimethoxysilane functionalization agent in the presence of isopropanol to form a pre-dispersion; (B) adding at least one epoxy monomer to the pre-dispersion to form a final dispersion; (C) at least partially removing the isopropanol from the final dispersion; *(D) subsequently adding an effective amount of hexamethyldisilazane*; and (E) substantially removing any low boiling components to form a final concentrated dispersion”.

Accordingly, Campbell does not anticipate the presently claimed invention. Furthermore, Campbell and the present application are each assigned to General Electric Company and the subject matter of the claimed invention, at the time it was made, was owned by the same person as owned Campbell. Therefore, Campbell is not ascertainable against the present application under 35 U.S.C. §103, and the rejection of claims 15 and 32 over Campbell in view of Wensel should be withdrawn.

**(IV) Claim 1 is patentable over Campbell, Crivello, Wensel, or combinations thereof**

Campbell, Crivello, Wensel, or combination thereof does not teach or suggest Applicants' claimed formulation. For example, when a molded disk made from Claim 1 formulation was exposed to UV flux from an argon laser at 406 nanometers (nm) at approximately 300 milliwatts for 24 hours, the decrease in transmission was less than 2% versus initial measurements. (Paragraph 43) For another example, functionalized material of Claim 1 exhibited greater than 10% improvement of optical transmission

versus typical LED encapsulants such as cycloolefin polymers and copolymers.  
(Paragraph 44)

Furthermore, removing the capping agent from all Campbell's claims, while maintaining old function(s) or gaining new function(s), is an indication of non-obviousness.

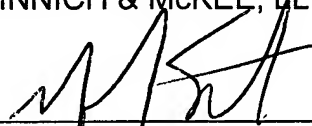
**(V) All other pending claims (i.e. 2, 4-19, and 21-34)**

All pending claims contain the same or additional limitations to those of Claim 1. Therefore, they are patentable for the reasons set forth above.

In view of the above, it is submitted that claims 1-2, 4-19, and 21-34 patentably distinguish over the prior art. Applicant respectfully requests an early indication of allowance of the application.

Respectfully submitted,

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